National Aeronautics and Space Administration

Goddard View

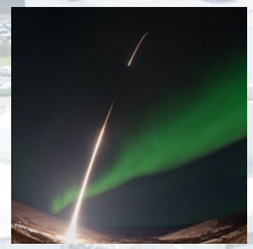
Volume 10 Issue 3
March 2014

GPM LAUNCHES

www.nasa.gov

GoddardView

THE WEEKLY

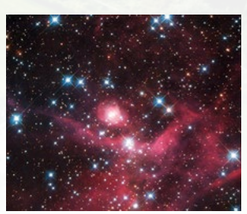


GREECE Mission Launches Into Aurora
On March 3, a NASA-funded sounding rocket launched straight into an aurora over Venetie, Alaska. The Ground-to-Rocket Electrodynamics–Electron Correlative Experiment sounding rocket mission, launched from Poker Flat Research Range will study classic curls in the aurora in the night sky. Click on the photo to discover GREECE.

Tournament Earth 2014
Thirty-two have been called, but which will be chosen? NASA's Earth Observatory is hosting the second annual Tournament Earth, a reader-driven competition to choose the previous year's top NASA image of our planet. Learn more and vote by clicking on the image.

Fiscal Year 2015 NASA Budget Request
NASA Administrator Charles Bolden and NASA Chief Financial Officer Elizabeth Robinson presented the 2015 NASA budget to the public on Tuesday, March 4. To review the NASA budget and supporting information, as well as Administrator Bolden's statement, click on the image.

Hubble Catches Cosmic Cloak of Red
This Hubble image shows a small part of the Large Magellanic Cloud, one of the closest galaxies to our own. This collection of small baby stars, most weighing less than the sun, form a young stellar cluster known as LH63. There's more to explore by clicking on the image.



GoddardView

On the cover: GPM lifts off to begin its Earth-observing mission.

Photo Credit: NASA/Bill Ingalls

GoddardView Info

Goddard View is an official publication of NASA's Goddard Space Flight Center. Goddard View showcases people and achievements in the Goddard community that support Goddard's mission to explore, discover and understand our dynamic universe. Goddard View is published by Goddard's Office of Communications.

You may submit contributions to the editor at john.m.putman@nasa.gov. Ideas for new stories are welcome but will be published as space allows. All submissions are subject to editing.

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GPM LAUNCHES

By: Steve Cole, Rani Gran and Takao Akutsu

The Global Precipitation Measurement Core Observatory, a joint mission between NASA and the Japan Aerospace Exploration Agency, thundered into space at 1:37 p.m. EST Thursday, Feb. 27 (3:37 a.m. JST Friday, Feb. 28) from Japan.

"With this launch, we have taken another giant leap in providing the world with an unprecedented picture of our planet's rain and snow," said NASA Administrator Charles Bolden. "GPM will help us better understand our ever-changing climate, improve forecasts of extreme weather events like floods, and assist decision makers around the world to better manage water resources."

The GPM Core Observatory will take a major step in improving on the capabilities of the Tropical Rainfall Measurement Mission, a joint NASA-JAXA mission launched in 1997. While TRMM measured precipitation in the tropics, the GPM Core Observatory expands the coverage area from the Arctic Circle to the Antarctic Circle. GPM will also be able to detect light rain and snowfall, a major source of available fresh water in some regions.

To better understand Earth's weather and climate cycles, the GPM Core Observatory will collect information that unifies and improves data from an international constellation of existing and future satellites by mapping global precipitation every three hours.

"It is incredibly exciting to see this spacecraft launch," said GPM Project Manager Art Azarbarzin of NASA Goddard. "This is the moment that the GPM Team has been working toward since 2006. The GPM Core Observatory is the product of a dedicated team at Goddard, JAXA and others worldwide."

The GPM Core Observatory was assembled at Goddard and is the largest spacecraft ever built at the center. It carries two instruments to measure rain and snowfall. The GPM Microwave Imager, provided by NASA, will estimate precipitation intensities from heavy to light rain, and snowfall by carefully measuring the minute amounts of energy naturally emitted by precipitation. The dual-frequency precipitation radar, developed by JAXA with the National Institute of Information and Communication Technology, Tokyo, will use emitted radar pulses to make detailed measurements of three-dimensional rainfall structure and intensity, allowing scientists to improve estimates of how much water the precipitation holds. Mission operations and data processing will be managed from Goddard.

"We still have a lot to learn about how rain and snow systems behave in the bigger Earth system," said GPM Project Scientist Gail Skofronick-Jackson of Goddard. "With the advanced instruments on the GPM Core Observatory, we will have for the first time frequent unified global observations of all types of precipitation, everything from the rain in your backyard to storms forming over the oceans to the falling snow contributing to water resources."

"We have spent more than a decade developing DPR using Japanese technology, the first radar of its kind in space," said Masahiro Kojima, JAXA GPM/DPR project manager. "I expect GPM to produce important new results for our society by improving weather forecasts and prediction of extreme events such as typhoons and flooding." ■

Above: A Japanese H-IIA rocket with the NASA-JAXA GPM Core Observatory onboard, is seen launching from the Tanegashima Space Center in Tanegashima, Japan. Photo credit: NASA/Bill Ingalls

"The future of space will be re-use, re-purpose and replenish."

TECHNOLOGIES PROVING ROBOTIC REFUELING IS POSSIBLE

By: Dewayne Washington and Adrienne Alessandro

The Satellite Servicing Capabilities Office at Goddard has successfully concluded a remotely controlled test of new technologies that would empower future space robots to transfer hazardous oxidizer—a type of propellant—into the tanks of satellites in space today. With this milestone off its checklist, SSSCO is preparing for new demonstrations—in orbit and on the ground—of real-time relative navigation, spacecraft inspection and the replenishment of cryogens in satellites not originally designed for in-flight service.

Since 2009, SSCO has been investigating human and robotic satellite servicing while developing the technologies necessary to bring on-orbit spacecraft inspection, repair, refueling, component replacement and assembly capabilities to space.

Building on the success of their landmark Robotic Refueling Mission demonstration on the International Space Station, the SSCO team devised the ground-based Remote Robotix Oxider Transfer Test (ROxiTT). The test demonstrated how teleoperated robots could transfer hazardous oxidizer, at flight-like pressures and flow rates, through the propellant valve and into the mock tank of a satellite not designed for servicing. Oxidizer—namely nitrogen tetroxide—is a chemical that, when mixed with satellite fuel, causes instant combustion that provides thrust (motion) for a satellite. Toxic, extremely corrosive and compressed, it requires special handling.

During operations, robot operator Alex Janas at Goddard commanded an industrial robot at the Kennedy Space Center, more than 800 miles away. Robotically, he was able to complete the preparations necessary and transferred propellant into a mock tank. At the conclusion of nine days of RROxiTT operations, the SSCO team declared victory.

RROxiTT technologies included a flexible propellant hose, a new Oxidizer Nozzle Tool, and a unique propellant transfer system all developed by a multi-Center SSCO team at Goddard and Kennedy Space Center. The system includes tanks, pumps, flow-metering devices, and tubing, necessary components for a servicer satellite to replenish the propellant and extending the life of orbiting spacecraft for many years.

While this capability could be applied to spacecraft in multiple orbits, SSCO focused RROxiTT specifically on technologies that could help satellites traveling the busy space highway of geosynchronous Earth orbit, or GEO. Located about 22,000 miles above Earth, this orbital path is home to more than 400 satellites, many of which beam communications, television and weather data to customers worldwide. Refueling capabilities could also help spacecraft in lower Earth orbit, the highway for many vital Earth-observing satellites.

Here on Earth, RROxiTT technologies could one day be applied to robotically replenish satellites before they launch, keeping humans at a safe distance during extremely hazardous operations.

Since wrapping up RROxiTT, SSCO is broadening its portfolio to include xenon transfer technologies—propellant used by satellites with electric propulsion systems, and the logical propellant most likely to be used for future tugs carrying logistical equipment for human exploration.

The team is also gearing up for the next phase of the Robotic Refueling Mission on the ISS. Upcoming demonstrations include spacecraft inspection, the replenishment of cryogens in satellites not originally designed for in-flight service, and advanced solar cell technology.

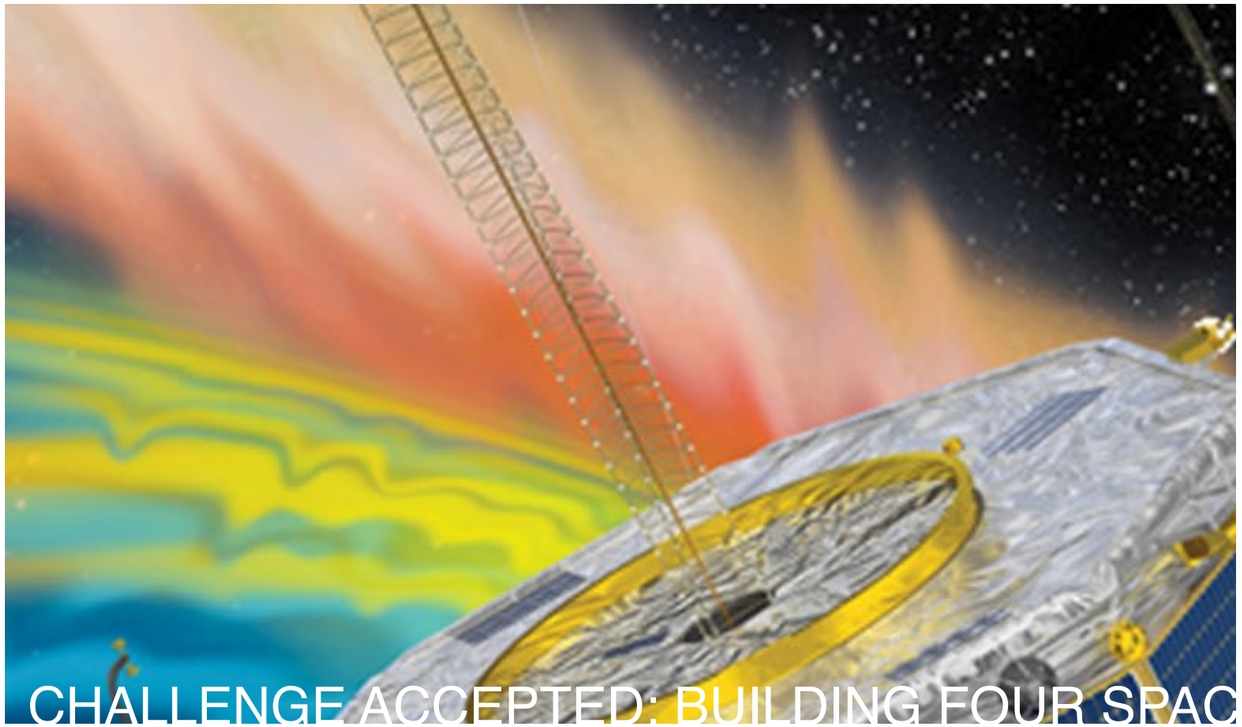
A separate ISS demonstration named Raven is scheduled to launch in early 2016. It will demonstrate a real-time navigation system that would empower spacecraft to autonomously rendezvous with both prepared vehicles and those not designed for servicing.

On the ground, SSCO will conduct a separate test at Goddard later this year. During this test, the team will command a full-sized robot servicer system to perform a series of servicing tasks on a suspended satellite mockup. Results will help the team evaluate how the numerous servicer subsystems and technologies work together as an integrated system to accomplish servicing objectives. The event will test both proven and newly developed technologies.

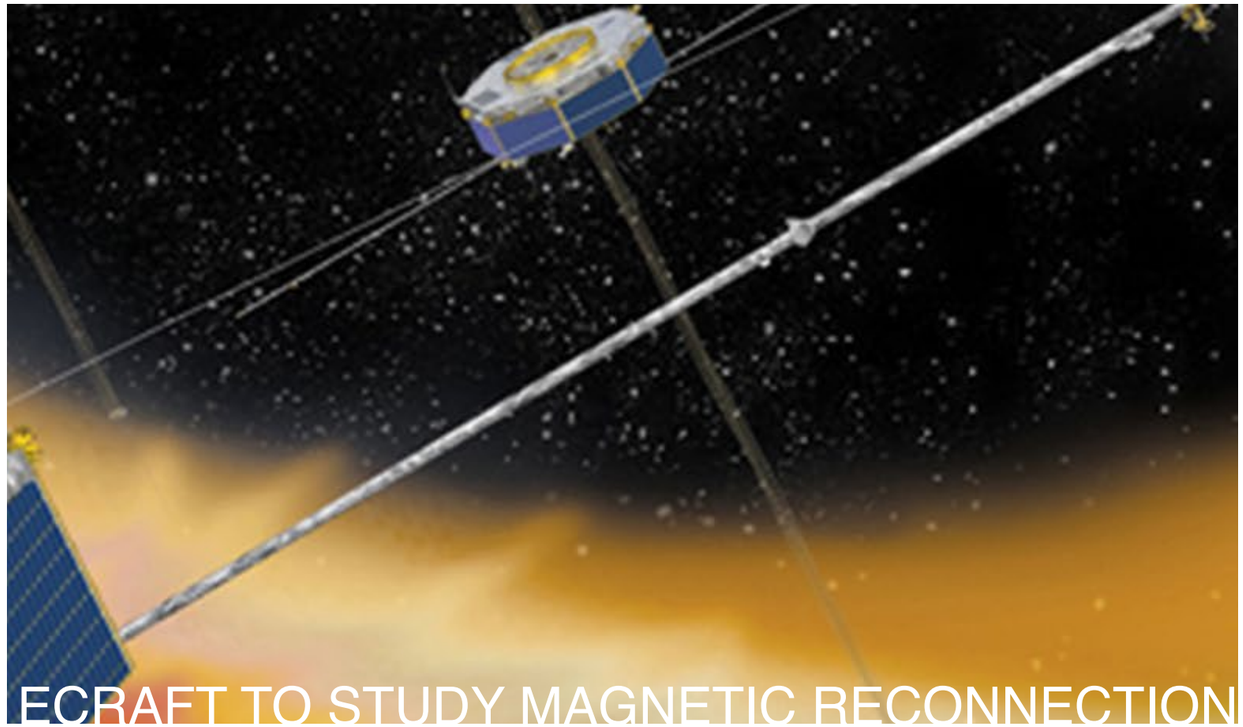
By developing robotic capabilities to repair and refuel LEO and GEO satellites, NASA hopes to add precious years of functional life to orbiting satellites. Also, expand options for operators who face unexpected emergencies, tougher economic demands and aging fleets. NASA hopes that these new technologies will help boost the commercial satellite-servicing industry that is rapidly gaining momentum.

"It's one thing to build a set of technologies and discover that they work," says Benjamin Reed, deputy project manager of SSCO. "It's another thing to consider the capabilities that they could unlock. The paradigm of one-and-done should be relegated to the 20th century—the future of space will be re-use, re-purpose and replenish." ■

Opposite: RROxiTT lead roboticist Alex Janas stands with the Oxidizer Nozzle Tool as he examines the work site. Photo credit: NASA/Goddard/Chris Gunn



CHALLENGE ACCEPTED: BUILDING FOUR SPAC



ECRAFT TO STUDY MAGNETIC RECONNECTION

By: Karen C. Fox

First thing every morning, the engineering team for NASA's Magnetospheric Multiscale mission gathers for a 10-minute meeting. A white board sits at the front of the room with the day's assignments—who will wrap tape around the wires, which instruments need to be installed where, which observatory needs to undergo its next test.

This is the nerve center for the MMS engineers and technicians at NASA's Goddard Space Flight Center. Goddard is tasked with an unprecedented feat for the center: building four identical observatories simultaneously. The four spacecraft will launch together on a single rocket and then maneuver out into a pyramid configuration to orbit Earth. On its journey, MMS will observe a little-understood, but universal phenomenon called magnetic reconnection, responsible for dramatic re-shaping of the magnetic environment near Earth, often sending intense amounts of energy and fast-moving particles off in a new direction. Not only is this a fundamental physical process that occurs throughout the universe, it is also one of the drivers of space weather events at Earth. To truly understand the process, requires four identical spacecraft to track how such reconnection events move across and through any given space.

Building four spacecraft at once has many advantages. It saves on time and mission cost. However, such a massive undertaking requires meticulous logistical planning.

"This is the first time NASA has ever built four satellites simultaneously like this," said Craig Tooley, project manager for MMS at Goddard. "It feels like we're planning a giant game of musical chairs to produce multiple copies of a spacecraft. One instrument deck might be 2/3 finished, while another one is 1/3 finished, and the same people will have to test a nearly complete deck one day, and install large components on another one another day."

One of the earliest important feats for this group of engineers and technicians came during the design phase. Each spacecraft must carry, in addition to the navigational and power instruments, 25 scientific instruments. These had to be carefully laid out so that each instrument had a full range of view and so that the eight booms sticking out from the spacecraft would not interfere with any other instrument's line of sight or electromagnetic systems.

The instruments themselves were constructed and assembled around the world at a variety of institutions. Each one was then shipped to Goddard to be placed in its specific spot on what's called the instrument deck.

Each spacecraft contains two decks, one for the science instruments and one for the power and navigation tools. The decks are made of two aluminum sheets bonded on either side of an inner, honey-comb-shaped layer also made of aluminum. The second deck is called the spacecraft deck. It supports a power box, a computer, transmitters and receivers, a star tracker to help with orientation, and batteries for power during solar eclipses. The two decks are attached to struts, with the instruments facing each other in the middle. A central thrust tube carries four propellant tanks. Solar arrays span the space in between the decks.

Above and beyond installing all the instruments, each spacecraft sports hundreds of wires that connect the instruments to the main computer and power sources, as well as the instruments to each other. Not only does this entire harness need to be installed, but technicians must hand wrap every wire in insulation to shield the sensitive instruments from electrical interference.

"The sheer amount of labor just to put in all these connections is stunning," said Gary Davis, spacecraft systems engineer for MMS at Goddard. "When you're building four at a time, the team doesn't get a break. If one spacecraft is in testing, then the team works on a different observatory."

It is just this kind of juggling that must be done every day: Which engineer goes where and which spacecraft goes into which cleanroom, as each follows its journey of instrument insertion, wiring, testing, and more engineering.

In addition to the physical engineering, the software on board must be tested too. Such testing requires that the spacecraft be powered up, which consequently prohibits simultaneous mechanical or electrical work.

"The work is so interesting and even fun, but with a schedule this complicated we have to make some careful choices about who is doing what," said Davis. "We also have to make sure the team pushes ahead at the right pace. We want to move ahead as quickly as safely possible, but no faster." Safety is, indeed, the team's number one concern.

Since May 2013 all four observatories have been integrated with all necessary science instruments and flight hardware. Since then, they have undergone a wide range of ground tests—rigorous electrical, vibration, acoustics and thermal testing to ensure they can withstand the launch and extreme environments of space and launch conditions.

After testing is complete, the four observatories will be shipped, two at a time, isolated on a truck bed with exquisite air and temperature control, to Astrotech in Titusville, Fla., for launch processing and then to NASA's Kennedy Space Center in Florida for launch. Engineers will complete the final closeout. The propellant will be loaded into the tanks. The spacecraft will be carefully encapsulated into the rocket fairing for launch. And, at last, after four years of engineering, the four observatories will finally fly. ■

Above: Illustration of the four MMS spacecraft in orbit within Earth's magnetic field. Image credit: NASA. Click on the image to watch the MMS engineering challenges video.

On Friday, February 28, NASA's Goddard Space Flight Center hosted its annual MLK/African American History Month celebration to commemorate the life and legacy of Dr. Martin Luther King, Jr. and to acknowledge the contributions of African Americans. The center-wide event was co-sponsored by the Equal Opportunity Programs Office and the African-American Advisory Committee.

This year, along with Goddard employees, two student groups were able to attend the program: Suitland High School Center for the Visual and Performing Arts jazz ensemble provided the musical selections for the event, and Mt. Zion Prep, a post-graduate basketball program based in Baltimore, Md., whose stated goal is to enhance self-confidence, build character, develop leadership skills and other fundamental principles that will enable young men to excel both on and off the court.

The event's keynote speaker, Dr. Marc Lamont Hill, is an American academic, journalist, author, activist and television personality. He currently serves as an associate professor at Teachers College, Columbia University and is also an affiliated faculty member at the Institute for Research in African-American Studies at Columbia University. He hosts the nationally syndicated television show "Our World" with Black Enterprise Television and online at HuffPost Live. He is also a BET News correspondent and a CNN political commentator. He was named one of "America's Top 30 Black Leaders Under 30″ by Ebony magazine in 2005.

Dr. Hill engaged the audience with anecdotes of his life experiences and lessons including obstacles and triumphs, educational journey and career paths, a period of homelessness and time spent as a political commentator on FOX News. His reflections on Dr. King's legacy, historical events like the "I Have a Dream" speech during the 1963 March on Washington, and on the challenges and progress of not only African Americans but all Americans, captivated and motivated the audience to do more. His call to action was clear; we don't have to travel far when there are those within our own communities in need of help. We can provide blankets for the homeless, words of encouragement to someone who needs uplifting, or mentorship so youth can see beyond their current environment to all the possibilities life has to offer. Hill's message invoked a simple question, one of self-reflection, "what legacy will I leave behind?"

Hill left two pieces of advice for the youth in attendance: "Figure out what you want to be in life and align your thoughts and actions according to your dream, but most importantly practice patience." He went on to say that in today's society, young people are so accustomed to the fast-moving pace of social media, the internet and immediate gratification that they are reluctant to put in the time it takes to accomplish their goals and dreams.

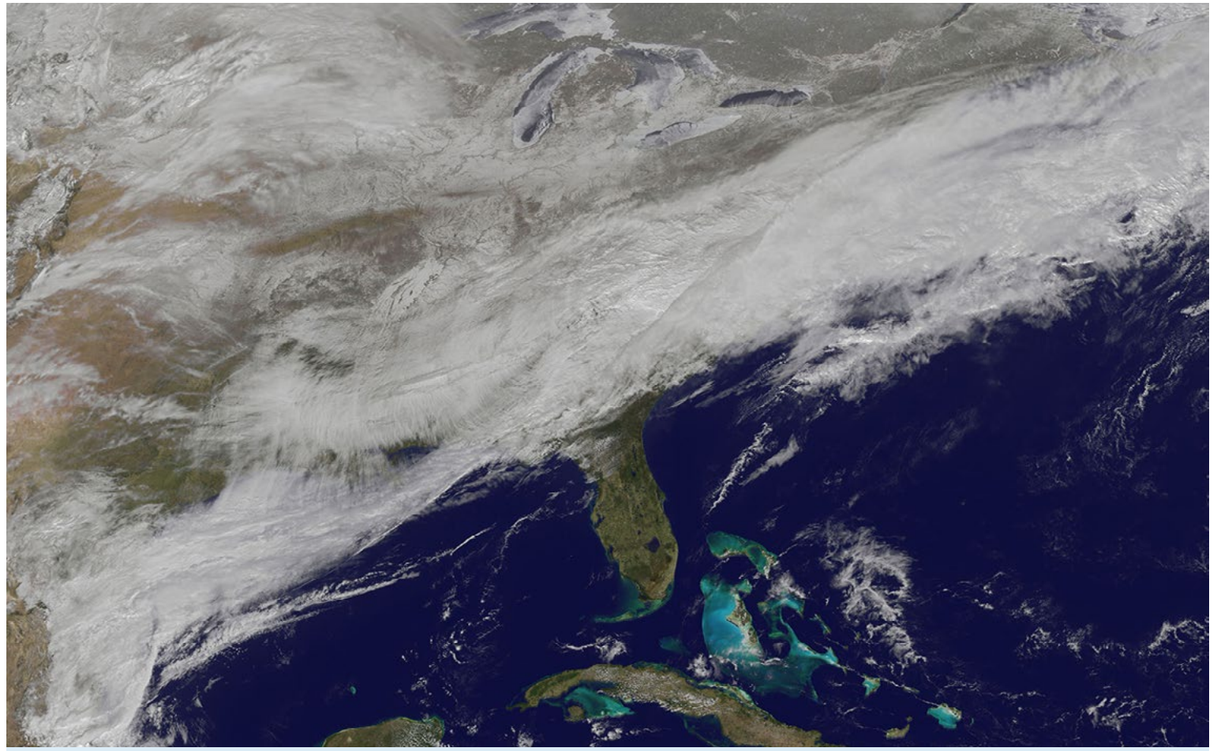
The next lesson came through another anecdote from when Hill was 19 and living on the streets. Another homeless man, a military veteran, told him he didn't belong there. The veteran went on to ask the youngster what he wanted to be in life to which he replied "a college professor." Hill then, however, lamented about being too old at 19 to return to school, the years it would take him to complete his degree, and so on. When he was done making excuses, the veteran replied, "Dummy, eight years is going to go by anyway; you just won't be a college professor!" It was the wakeup call he needed to change the course of his life.

As Hill's presentation came to a close, he was met with a standing ovation, reflecting the impact his speech had on the audience. The event closed with Goddard Center Director Chris Scolese presenting Hill with a plaque of appreciation on behalf of the center. ■

Photo credit: NASA/Goddard/Bill Hrybyk

REFLECTING ON THE DREAM

By: Leslee Cork



On March 3, a major winter storm brought snow to the mid-Atlantic, freezing rain to the Carolinas and rain and some freezing rain to the Gulf Coast states. NOAA's GOES-East satellite captured an image of the clouds associated with the winter storm on March 3 at 12:45 p.m. EST (1745 UTC)/ as it continued on its march over the mid-Atlantic.

Bands of snow and sometimes heavy snow affected the Washington, D.C., region, Delaware and central Virginia, stretching west into West Virginia and eastern Kentucky. Snow also stretched back into the Ohio and Tennessee valleys while rain and freezing rain affected the Carolinas, and while the Gulf Coast states received rain. National Weather Service Winter Storm Warnings remained in effect until 6 p.m. EST on March 3 for Washington, D.C., and Baltimore, Md. In Richmond and Norfolk, Va., the Winter Storm warnings were in effect for six additional hours ending at midnight.

On March 3, NOAA's National Weather Prediction Center in College Park, Md., noted the late-season winter storm will continue to shift eastward through the Tennessee Valley and the mid-Atlantic today, making for hazardous travel conditions. NOAA noted that unseasonably cold temperatures more typical of January will prevail east of the Rocky Mountains for the next few days keeping winter around for a while longer.

The clouds are associated with a cold front that stretched from eastern Maine through Maryland and west into the Tennessee Valley. At NASA/NOAA's GOES Project at NASA's Goddard Space Flight Center in Greenbelt, Md., the cloud data from NOAA's GOES-East satellite were overlaid on a true-color image of land and ocean created by data from the Moderate Resolution Imaging Spectroradiometer, or MODIS, instrument that flies aboard NASA's Aqua and Terra satellites. Together, those data created the entire picture of the position of this major winter storm.

GOES satellites provide the kind of continuous monitoring necessary for intensive data analysis. Geostationary describes an orbit in which a satellite is always in the same position with respect to the rotating Earth. This allows GOES to hover continuously over one position on Earth's surface, appearing stationary. As a result, GOES provide a constant vigil for the atmospheric "triggers" for severe weather conditions such as tornadoes, flash floods, hailstorms and hurricanes. ■

Photo credit: NASA/NOAA/GOES Project. Click the image to watch animation of the storm.

SATELLITE SEES STORM MARCH OVER MID-ATLANTIC

By: Rob Gutro

GPM AT THE VISITOR CENTER

Photos credit: NASA/Goddard/Debora McCallum

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By: Claire Saravia

As a senior research scientist studying Earth climate change, Ralph Kahn is used to working with researchers to study how particles in the atmosphere affect the planet's climate. But behind his groundbreaking research, Kahn has another passion: helping build the different Goddard communities of which he is part.

During his NASA career, Kahn has developed different science communities that share a common goal—delivering important science information to the public.

Although each community involves different types of people—ranging from scientists and engineers to teachers and journalists—Kahn said each one is focused on communicating science, an act he considers a necessity.

"I feel a responsibility to communicate, and the integrity of science and community is very high," Kahn said. "Not all of it is for every scientist, but I enjoy it and feel it's a responsibility, and I feel we should all do what we're best at."

For Kahn, communicating science comes naturally. At an early age, he was torn between pursuing writing or science as a career. Eventually, Kahn elected science, but his love for writing and communicating remained.

"I was good at science and was interested in it, but at times I was torn between science and writing as a major activity," Kahn said. "I've always liked to write, and I try to write everything well, and I think that's a value."

While Kahn said that not all scientists are good at communicating their work, he said it was a skill he felt obligated to use.

"There's a lot of encouragement for scientists to get out there and speak to the public," Kahn said. "Not every scientist is comfortable talking to different kinds of audiences, but for me the writing is a reflection of who I am and what I do, whether it's technical or popular."

"It's very different to have a scientist talk about this stuff than someone who's packaging what they see us doing," Kahn said. "It's important for people to see the faces of science."

It's these faces of science that Kahn has helped build into unique communities since coming to Goddard, a place he considers to be a mecca for diversity.

"One of the things I like about Goddard is there's a broad field of expertise and interests," Kahn said. "It's a very rich environment to do this kind of interdisciplinary work."

Working around a diverse group of people has enabled Kahn to build an especially large community he started nearly 20 years ago, after JPL managers asked him and his colleagues to help solve the science literacy problem plaguing the country's students. In 1996, Kahn started Practical Uses of Math and Science, an online platform for schoolteachers to access real life case studies of science and math concepts.

Kahn said he received much of his inspiration for community-driven projects like PUMAS from the communities that form during field campaigns, which embody NASA's full scope of diversity. When out doing field research, Kahn said he has a chance to work with scientists he wouldn't otherwise work with, providing an opportunity to share research in a unique way.

"Field campaigns are the ultimate science melting pot in my field," Kahn said. "It does influence me a lot in drawing communities together, because it models a different kind of community."

Although Kahn has done a lot of work promoting different science communities up to this point in his career, he said working at Goddard has been instrumental in continuing to build others.

"I was part of communities before, but Goddard is a crossroads," Kahn said. "There's just so many people in related disciplines, and Goddard makes that possible."

Kahn said he hopes to continue immersing himself in Goddard's diverse workforce in the future to keep building unique communities, both here at Goddard and beyond.

"So many of the people here are so talented in more than one way, so it only makes sense to view people as multidimensional," Kahn said. "For me, communities are part of what I do best." ■

Center: Ralph Kahn. Photo credit: NASA/Goddard/Bill Hrybyk